Space Weather Technical Forecast

Issued on Sunday 17 November 2024 at 00:20 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Daily Chance of R1. Slight Chance G1 in first half of forecast period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity measured at GOES16 has been Moderate during the past 24 hours, with a peak flare of M1.6 at 16/0137UTC from AR3889 in the southwest, currently identified as an Fho/Beta-Gamma. Previously weak Mt Wilson delta spots are no longer evident, perhaps partly because of the narrowing viewing angle.

There are currently four numbered sunspot regions on the visible disc. The largest remains AR3889 in the southwest, however this showed a relatively open configuration and a reduction in the number of small spots surrounding the large penumbral spots, with an overall reduction in area and complexity. Other regions were unipolar and largely unchanged.

No Earth-directed CMEs were observed over the past 24 hours in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds at L1 measured by ACE were perhaps indicative of the tail of influence from northern CH90/+, but likely gave way to a slow regime during the UTC evening as the IMF fell away.

The solar wind speed was roughly level through the 24 hours in the upper 300s of km/s. The solar wind density was within typical background levels in single-figures ppcc, but showed a step upwards around 16/2000UTC, which was perhaps a resumption of a slow regime when considered with a concurrent fall in the IMF to near 5nT from earlier peaks of 8nT. The north-south component showed a gradual drift from being mainly anti-aligned with Earth's field and a minimum of -7nT, to peak near 6nT. The phi angle was positive (away from the Sun) throughout.

The net result of the above solar wind measures was provisionally Active geomagnetic activity falling to Quiet, with a peak of '4o' observed in the 00-03UTC interval.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at Background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was at Normal Background to Moderate levels, with a diurnal peak of 346pfu observed at 16/1810UTC. The associated 24-hour

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fluence remained below the Active threshold, and the 24-hour integrated flux observed at 16/2359UTC was a rising trend to 1.1e7.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a slightly higher Chance of both M- and X-class activity relative to the recent past, with the arrival of a succession of returning regions expected over the eastern limb into the new UTC week.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast.

The geomagnetic forecast therefore solely consists of an inbound coronal hole fast wind from CH92/+ mooted for later in the current UTC day. There is a corresponding Slight Chance of G1 Minor geomagnetic storm intervals resulting, with the risk waning before midweek UTC to Quiet.

Energetic Particles / Solar Radiation: There is a daily Slight Chance of S1/Minor solar radiation storms due to AR3889's position as it nears the western limb.

The high energy electron flux is expected to remain at predominantly background to moderate levels, although there is a chance of reaching High levels during diurnal peaks later in the period. The associated fluence will nevertheless most likely remain below Active (1e8 integrated flux).

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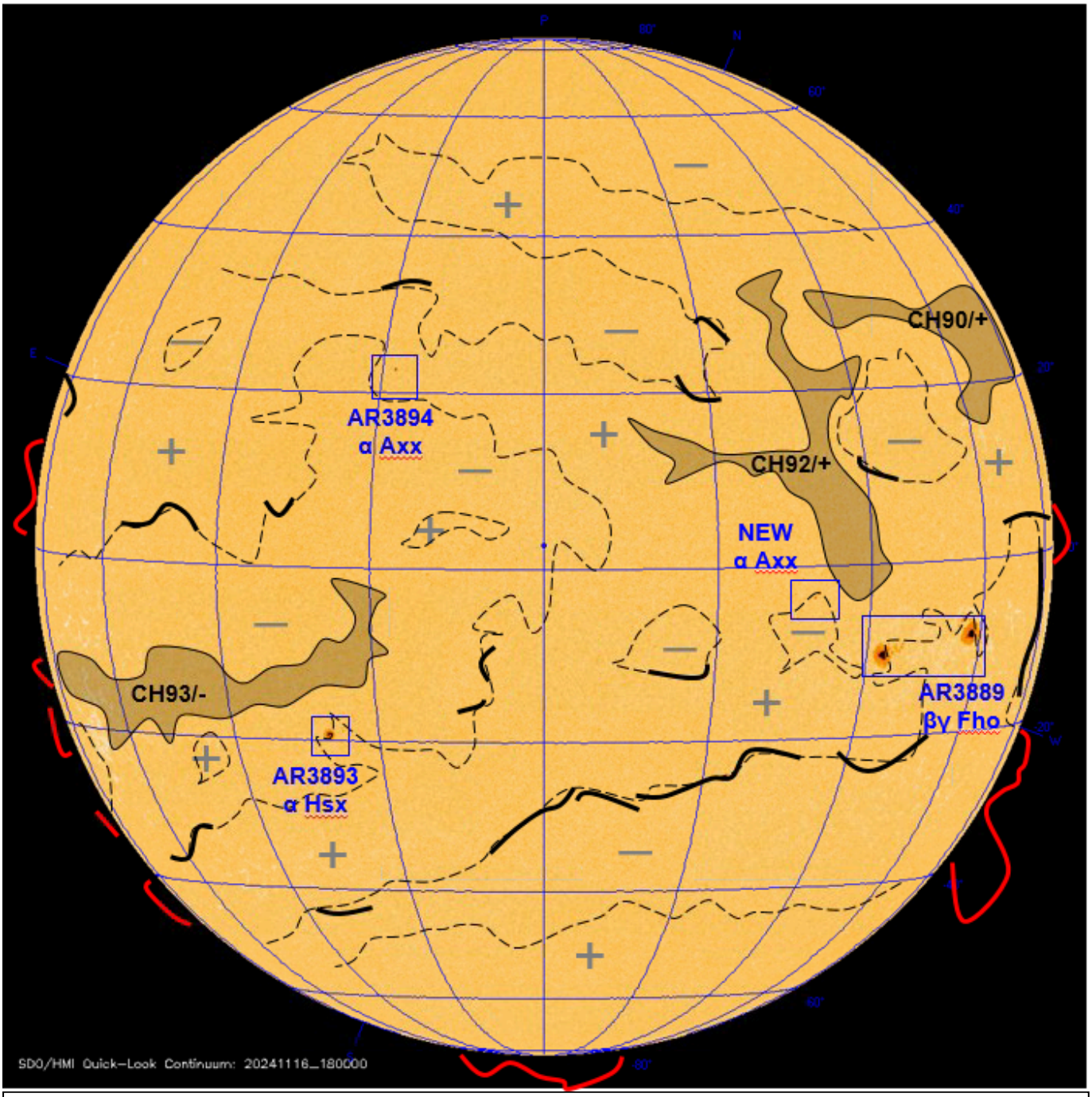
Figure 1: Solar synoptic map, valid 16/1800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

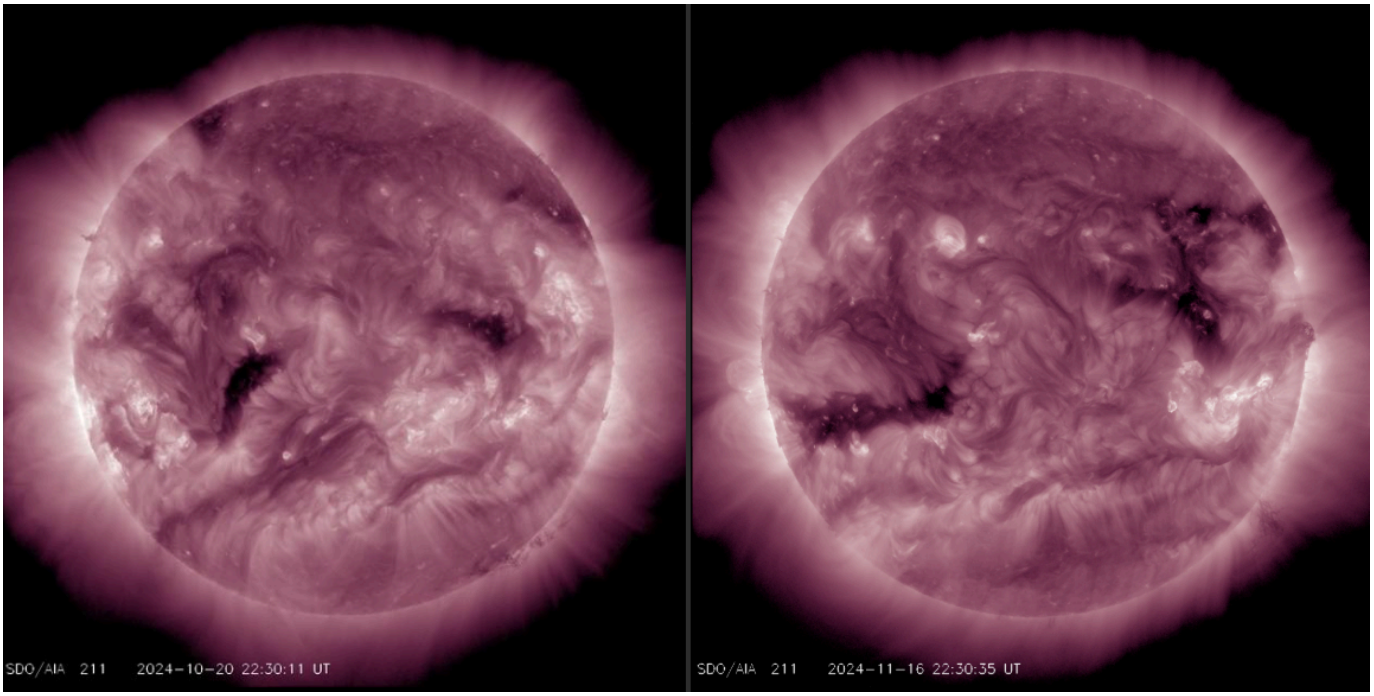
No CMEs feature in the forecast.

In terms of coronal hole fast winds, there is a likelihood of elevated wind speeds of around 500km/s occurring later in the current UTC day with a connection to a HSS from CH92/+. This feature is slightly larger compared to last rotation, when speeds of around 450km/s occurred, and a general increase also suggested by MOSWOC Enlil output.

There is a corresponding Slight Chance of G1 partitioned between the first two UTC days of the period, waning through day three (Tuesday 19 November) to become Quiet by midweek.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Comparison of AIA211 imagery from the past rotation (20 October, left) and current (right), showing increased extent of CH90 and CH92. Being relatively nearer the solstice may counteract any increased intensity.



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Radio Blackouts - X-Ray Flares

Of the current front-sided sunspot groups, AR3889 in the southwest maintains the bulk of the current flare risk, but this is perhaps reducing somewhat given the apparent simplification of the region. The remaining regions are small and magnetically simpler, although the recent M1 flares from region AR3893 in the southeast show that they can not be completely discounted.

No particularly large far side regions are suggested by far-side sounding data, however these are clustered near the eastern limb and this minimises the signal from soundings. Recurrence instead suggests the potential for sunspot regions to return to the visible disc over the remainder of the UTC weekend, with this supported by some brightening of the western limb in SDO/AIA imagery and recent far-sided CMEs.

Overall Low to Moderate activity is expected, with the arriving regions making for a now higher daily Chance of isolated M-class flares and a Slight Chance of X-class flares.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	40	40	40	40
Very Active	R3-R5 (X Class)	No	10	10	10	10

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Solar Radiation Storms (High Energy Protons)

There is a slight chance of S1/Minor Solar Radiation storms over the period, chiefly due to any potential significant flaring from AR3889 as it nears the western solar horizon. The series of inbound eastern limb regions are unlikely to present any appreciable risk to the daily probabilities of S1 for some time yet.

The changes in AR3889 to become a simplfying Fho group have resulted in a slightly lower risk relative to the recent past, still rising slightly to peak around midweek UTC when this spot group crosses the limb.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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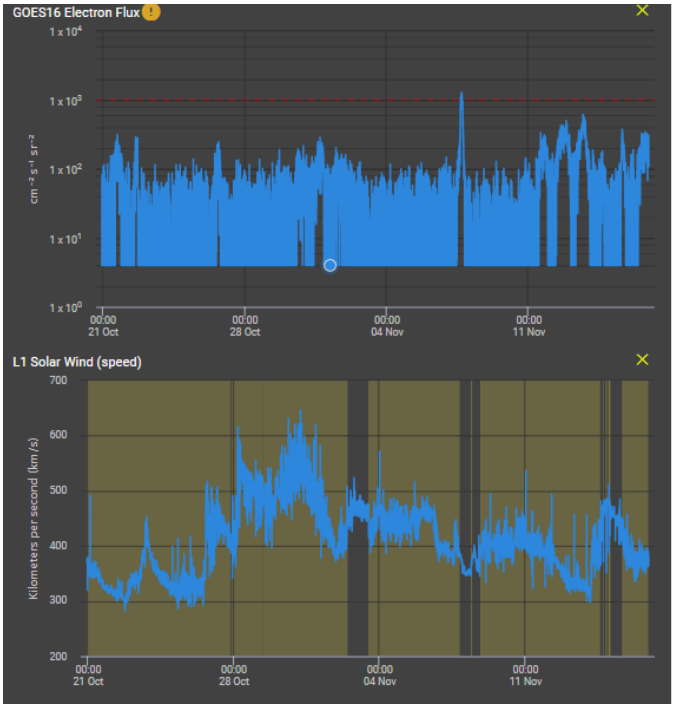
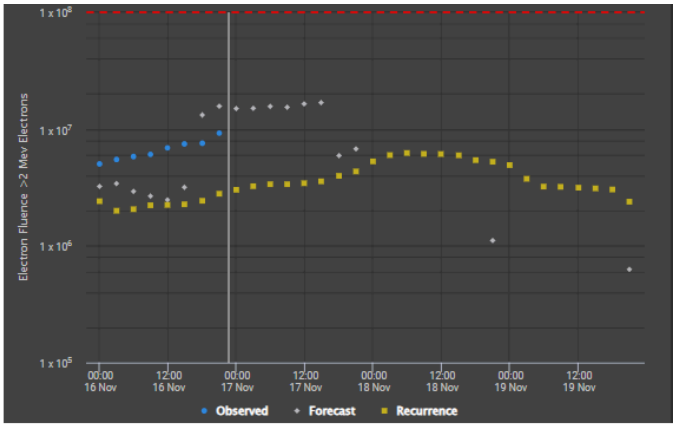
High Energy Electrons (≥ 2MeV)

High energy electron flux at GEO may be suppressed later in the current UTC day by the onset of any fast wind from CH92/+. The expected rebound here by around Tuesday 19 November is unlikely to be of sufficient magnitude to trouble the Active 24-hour integrated threshold - no persistent feature on the disc has resulted in Active fluence. All considered, there is a slightly rising Slight Chance of Active fluence, peaking before midweek UTC.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	5	5
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 3: Clockwise from top left: past 27 days in GOES16 high energy electron flux; past 24 hours 24-hour integrated fluence (blue dots) and three-day forecast (white); Driving 27-day L1 solar wind speed. Note that no feature has resulted in Active fluence this rotation.





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